SELECTIVE LOBOTOMY IN THE TREATMENT OF INTRACTABLE PAIN*

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THE MANAGEMENT OF patients with intractable pain in whom the primary cause is irremediable has confounded the medical profession since the beginning of time. The primary pathologic condition in the majority of cases is malignant disease, and in many instances the progress of the disease is so slow that the patient is doomed to many months or even years of suffering before death ensues. Many other pathological states, notably phantom limb, causalgia, tabes dorsalis, and atypical facial neuralgia fall into the same general category.

Surgical efforts to relieve intractable pain are as old as the science of surgery itself. Denervation of the painful areas by peripheral nerve section or by posterior root section has been and continues to be successful when the painful area is limited to a small, well defined segment of the body. Perhaps the best example of this type of operation is trigeminal posterior root section for *tic douloureux*.

A new chapter in the surgical treatment of intractable pain was written when Spiller[19] and Frazier[3] demonstrated that sectioning the lateral spinothalamic tract in the spinal cord was a feasible and essentially non-mutilating procedure in man. This ingenious operation, usually referred to as cordotomy, severs the pain pathways in the spinal cord without damage to motor pathways and without disturbing the highly important pathways conducting position, touch, muscle, bone and joint sensibility. With certain refinements, this operative procedure remains the method of choice in relieving intractable pain of somatic origin in the lower two-thirds of the body. If one lower extremity alone is involved, unilateral cordotomy is highly effective. The bilateral procedure must be used if both lower extremities or the pelvis and abdominal structures are within the pain pattern. The greatest handicap associated with the procedure is the high incidence of sphincteric disturbances when bilateral cordotomy is performed. Also, the success of cordotomy, either unilateral or bilateral, is markedly reduced when drug addiction already exists.

Another development of importance in the treatment of certain types of intractable pain was the observation[20] that pain of ischemic origin is relieved by sympathetic denervation of the part. Subsequent observations[14] showed beyond reasonable doubt that causalgia associated with injuries to peripheral nerves responded equally well to sympathetic denervation.

The most recent development in the attack upon the problem of intractable pain is frontal lobotomy. Freeman and Watts[4] observed in the course of their studies of psychiatric patients treated by prefrontal lobotomy that some of them who had complained bitterly of pain before the operation were comfortable afterwards. This observation led them, in 1946, to perform the first prefrontal lobotomy upon a patient with intractable pain without psychosis. The results were gratifying. Since then many observers[2, 7, 10, 12, 15, 17] have reported

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similar results. The chief importance of the procedure is the change that takes place in the patient's emotional reaction to pain. Some patients may voluntarily complain of pain, but it seems to be of less disturbance to them than before lobotomy. Others will speak of having pain only when questioned.

In 1949 one of us (E. G. G.)[8] devised an entirely different type of operative technic for the selective destruction of certain portions of the prefrontal lobe. Experience has shown that this procedure eliminates two of the major criticisms of prefrontal lobotomy, namely, intellectual deficits and convulsive seizures. Our experience with this new procedure in the treatment of intractable pain is the subject of this report.

OPERATIVE TECHNIC

In 1945 Hofstatter, Smolik and Busch[11] and Dax and Radley-Smith[1] showed that by limiting the lesion in the white matter to the lower two quadrants of the frontal lobe, results were equal to or improved over those operated upon by the standard technic. In 1948 we found that results similar in all respects to the complete operation were achieved by division of the fibers of the two medial quadrants of the prefrontal lobe. The bimedial operation was also successful for the relief of intractable pain.[7] Therefore, in planning the new operative procedure it was decided to limit the lesion to the medial ventral quadrant, and if the results were not entirely satisfactory, to make a similar lesion of the dorsal ventral quadrant later, thus destroying the association pathways from the medial and orbital surfaces of the prefrontal lobe.

The lesions are produced by electrocoagulation with a high frequency current applied through the special needle electrode (Fig. 1). The skull is entered through bilateral burr holes placed within the hair line 6 or 7 cm. above the glabella and 2½ cm. from the midline. During the preparation of the operative field a line is marked on the scalp from the lateral rim of the orbits to the burr hole sites for orientation of the plane into which the electrodes are to be introduced into the frontal poles. A ventricular needle is first inserted in this plane into the frontal lobe and carried gently to the floor of the anterior fossa in order to measure the depth of the brain—usually between

FIG. 1.—A drawing of the electrode. The insulated portion is 2 mm. in diameter. The exposed tip is 1 cm. in length. Marks on the electrode at 5, 6 and 7 cm. aid in their proper placement.

7 and 8 cm. Unless there is ventricular enlargement, the needle will pass anterior to the frontal horn of the lateral ventricle. Then the ventricular needle is withdrawn and reinserted posteriorly until the tip of the ventricle is encountered. The available ventricular fluid is replaced with oxygen. The electrodes are introduced in the original plane, care being taken that their course parallels that of the sagittal sinus. The tip of the electrode is passed to a point 2 cm. from the floor of the skull. For example, if the depth of the anterior fossa is 8 cm., the electrodes are introduced to a point 6 cm. below the exposed dura. A lesion at

this site avoids direct damage to the orbital cortex of the frontal poles by the electrocoagulation. Roentgenograms in the anterior and lateral position are then made to verify the exact position of the electrodes in their relationship to the ventricular system (Figs. 2 and 3). If the tip of either electrode is not in the correct position to destroy the white matter in the medial ventral quadrant, they are reinserted until they are shown by the roentgenograms to be correctly placed.

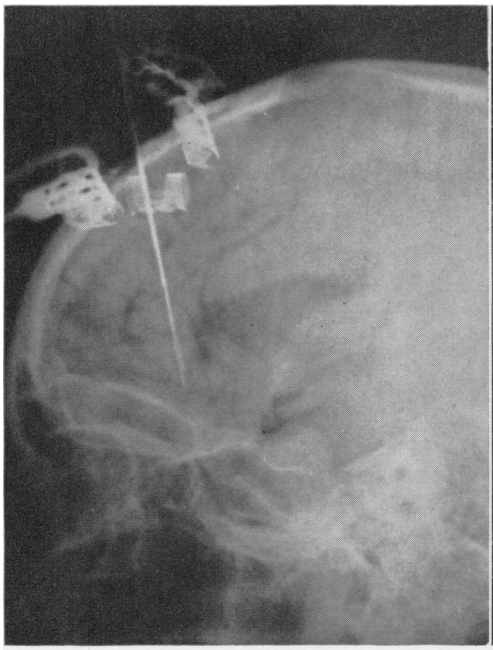

FIG. 2

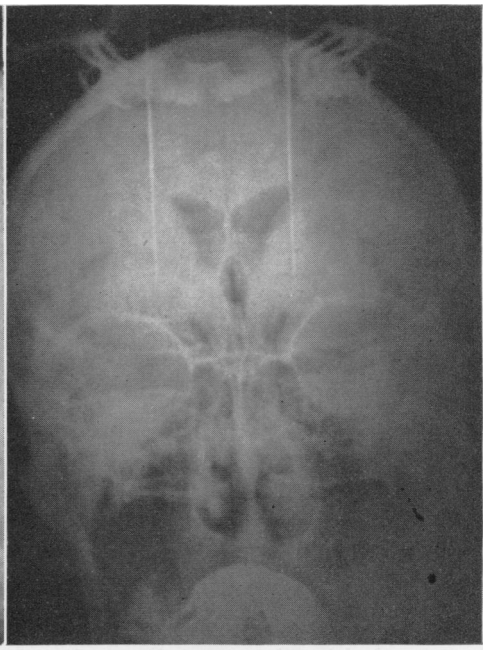

FIG. 3

FIG. 2.—Lateral roentgenogram showing the two electrodes symmetrically placed in the medial ventral quadrant and approximately 1 cm. anterior to the lateral ventricle.

FIG. 3.—Anteroposterior view showing the electrodes in the proper relation to the ventricular system and the exposed tip of the electrode in the medial ventral quadrant.

To determine the proper power setting of the electrosurgical unit, a bit of subcutaneous tissue is grasped with fine pointed tissue forceps and that amount of current required to char this soft tissue in 4 seconds is taken as the basic setting of the machine. The electrocoagulation current is then applied to each electrode for 45 seconds. The electrode is then withdrawn 1 cm. and a second application made for the same period of time. The lesions thus produced are cylindrical, measuring 2 cm. in length and from 1½ to 2 cm. in diameter. This is sufficiently large to destroy the majority of the white matter of the medial ventral quadrant of the frontal lobe at this location (Fig. 4).

SELECTION OF PATIENTS

In the beginning of this clinical investigation, only patients in the terminal stages of malignant disease were selected for operation. All of these patients were addicted to morphine and no other operative procedure offered any prospect of relief of the pain and relief of the drug addiction. In addition, since these patients were in a terminal state, necropsies provided an opportunity to study the size of the lesion and compare it with the clinical effectiveness of the procedure.

Later the operation was offered to patients other than those with malignancy, in whom other pain-relieving operations were not applicable or had failed. To date there have been 71 operations upon 51 patients. Eighteen of the patients had a second-stage procedure and two of them a third-stage procedure. The underlying cause of the painful states was as follows: Malignant disease 35, atypical facial neuralgia 3, abdominal disease of undetermined origin 2,

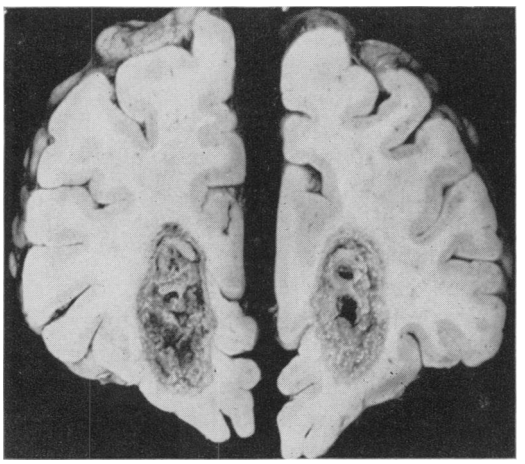

FIG. 4.—A coronal section of the brain showing the area of necrosis in the medial ventral quadrants. This patient died 3 weeks after surgery from generalized metastasis of his malignant disorder.

paraplegia 2, causalgia 2, thalamic syndrome 1, amebic liver abscess, scleroderma, ununited fracture of the femur, arthritis, complicated lumbar disc disease, tabes dorsalis 1 each.

RESULTS

Twenty-four patients lived less than three months after operation and one patient could not be contacted for follow-up information. In this group 15 patients (62.5 per cent) obtained highly satisfactory results, *i.e.*, their pain became tolerable and narcotics were no longer required. It should be pointed out that all patients of this group were in the terminal stages of malignant disease and 10 of them were among the first to be operated upon by this method, before the technical details were perfected.

More significant follow-up information was obtained upon the group of 26 patients who survived from three to 43 months, with an average survival of 15 months.

The relief of pain in 19 patients (73 per cent) was highly satisfactory. Eight patients would state that they had pain only upon being questioned by the examiner, and 11 did not acknowledge suffering even upon being questioned. Ten of the 19 patients were addicted to morphine and after operation required no further opiates. All of this successful group showed conspicuous tenseness and anxiety. Eight patients suffered from malignant disease, one severe lightning pains of tabes dorsalis, and one severe neuritis secondary to rhizotomy. The other nine patients were considered by the psychiatrist to have a severe psychogenic overlay in that their complaints were out of proportion to their organic disease. Each of these nine patients had disability of long standing and each of them had had one or more unsuccessful major operations before lobotomy. Of the 13 patients who are still living, six females are carrying on their usual household duties, three males are gainfully employed, and four are semi-invalids because of the primary disease.

In seven patients (27 per cent), we considered the operation to be either an indifferent result or a failure. Four patients were temporarily relieved of morphine addiction but subsequently returned to the use of the drug. One patient had three separate lesions produced in both frontal poles but the remainder had only one operation confined to the medial ventral quadrant. The conspicuous feature of the failure group was the absence of psychogenic overlay.

No patient upon whom this operation has been performed for either intractable pain or psychosis (132 patients) has developed convulsive phenomena. In none of the patients on whom the operation was performed for intractable pain has there been detectable personality change. There has been one operative death in the series—an

operative mortality of 1.4 per cent and a case mortality of 1.9 per cent.

DISCUSSION

Experience with lobotomy, both the standard and the limited procedures, indicates clearly that this operation is no panacea for intractable pain. In some cases the operation appears to be successful for a short period, only to have the severe pain and the necessity for narcotics reappear after two or three months. It is quite evident from our results that the operation has more to offer those patients in whom tension and anxiety with narcotic addiction are complicating factors.

In considering the type of operation to be advised in any patient with intractable pain, it is important to differentiate clearly between the individual's perception of pain and his reaction to it. Thresholds of painful stimuli vary from individual to individual, so that what may be an intolerable pain to one may be shrugged off by another. Likewise, the reaction to pain as an emotional experience varies widely among individuals. The reaction to pain, therefore, is a specially important factor in selecting the pain-relieving procedure to be employed. It is particularly important to determine the degree of addiction to morphine or other pain-relieving drugs before selecting any operative procedure. Even with the best cordotomy or sympathectomy, if the patient is addicted to morphine, the end-results may be poor. That is not the case when lobotomy is recommended, for in our series the desire for pain-relieving drugs vanished in 27 of 35 (77 per cent) addicts following the operative procedure. Finally, there is that large group of disabled individuals in whom a large psychogenic element overshadows the apparently insignificant organic disorder. Such patients complain of disabling pain, yet the pathological state which is found cannot fully explain such disability. Treatment is uniformly unsuccessful in their parade from doctor to doctor, and in some instances from one surgical procedure to another. Meanwhile they become increasingly unable to adjust to a normal life.

The original case reports of prefrontal lobotomy for intractable pain were those in whom a complete section of the white matter of the prefrontal lobe was done, either according to the technic of Watts[5] or of Lyerly.[13] This complete operation had the distinct disadvantage of causing measurable damage to intellectual functions with undesirable changes in personality. In addition, 12 per cent of the patients subjected to this procedure develop epileptic seizures.[6] These disadvantages are grave enough to limit the usefulness of this procedure in treating a large group of patients disabled by intractable pain.

Many reports[1, 7, 11, 18] are now available which indicate that limited lobotomy offers equal success to the complete procedure and that the complete procedure therefore need not be used. Several independent workers[7, 9, 16] have shown that the fibers of the medial quadrants are the important ones to be divided in a lobotomy. In our experience, the lower medial quadrant fiber section gives as good results as other procedures in psychiatric patients and therefore should give equally good results in those operated on for pain, as do the larger operations. An extension by a second operation in the upper medial quadrant, however, should be used if the original operation is not successful, as there is evidence that such an extension may convert a partially successful into a successful result. The operation described here offers a method of precision to increase the size of the lesion in stages, and at the same time protect the cortex and the lateral quadrants from damage, thereby minimizing the possibility of epileptic seizures and undesirable mental or personality changes. There have been no epileptic attacks in any of our patients upon whom 132 operations have been per-

formed in the last 44 months for either pain or psychosis.

SUMMARY

A new method of selective destruction of certain areas of the prefrontal lobe is described which eliminates many of the undesirable results accompanying the standard lobotomy procedure. Selective prefrontal lobotomy has a definite place in the treatment of intractable pain, but the results are not always predictable. On the basis of our experience to date, the operation should be reserved for those patients with or without drug addiction in whom extreme tension and anxiety are a prominent part of the total evaluation of the patient.

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DISCUSSION.—DR. GILBERT HORRAX, Boston, Mass.: It was a great pleasure to me to hear Dr. Spurling's paper on selective lobotomy for intractable pain. He is quite right in assuming that lobotomy, even in the minor lesions that are made by him and Dr. Grantham, should be used as rather a last resort for relief of intractable pain where it cannot be approached directly. He spoke of cordotomy and other means of attacking pain directly, which all of us who are doing neurosurgery feel is a wise thing, but this is nevertheless a distinct step forward from the old lobotomy procedure where there were mental changes, and the more one can reduce these the better. So far as I know, the lesions made by Dr. Spurling and Dr. Grantham are the most minimal ones which would accomplish this result.

Dr. Spurling did not speak of the possibility of doing a unilateral operation. It is perhaps not necessary in his cases because he gets no mental